59. The ~~conduit~~ method of claim 54, wherein said thermoplastic material is PVC.

60. The ~~conduit~~ method of claim 54, wherein said PVC has a tensile strength of between 5,000 to 10,000 psi.

REMARKS

Applicant submits that the above amendments to claims 47 and 56-60 adequately address the Examiner's objections raised in paragraphs 6 and 12 of the Office Action of January 15, 2002.

In paragraphs 9 and 11 of the Office Action the Examiner has objected to claims 51 and 58 on the basis that they are indefinite and contain new matter. The Examiner has stated that the resin/monomers recited in claims 51 and 58 are not recited in the original specification.

As the Examiner has pointed out, the original specification recites the use of 2-propanoic acid, 2-hydroxypropyl ester, chloroethane and ethenyl acetate at page 14, lines 17-18. This reference is misspelled and accordingly has been corrected by amendment above to 2-propenoic acid, 2-hydroxypropyl ester, chloroethene and ethenyl acetate.

Applicant encloses herewith a copy of a printout of the Chemical Abstracts Service (CAS) Registry data for the chemical compound whose CAS Registry Number is 41618-91-1.

The printout discloses 8 alternative names for compound number 41618-91-1. The first name is 2-propenoic acid, 2-hydroxypropyl ester, polymer with chloroethene and ethenyl acetate, the name originally given at page 14, lines 17-18 of the specification. The seventh name is poly(vinyl chloride-co-vinyl acetate-co-2-hydroxypropyl acrylate), the name used in claims 51 and 58. Applicant submits that both names are equivalent and acceptable means for identifying the same compound, however, in the interest of consistency of terminology, claims 51 and 58 have been amended to refer to the compound as originally described in the specification.

In paragraph 8 of the Office Action the Examiner has rejected claims 47-60 on the basis that the term "layer" was not used in the original application and therefore constitutes new matter.

Referring to Figure 9 and to pages 21-24 of the specification, a cross-section of the conduit of the present invention is described with reference to specific components thereof. Applicant notes that reference numeral 54 refers to the thermoset region. Applicant wishes to draw the Examiner's attention to page 24 line 9 of the specification where reference is made to "layers or regions of the thermoset region 54". Applicant submits that this contradicts the Examiner's assertion that component (b) of claim 47, namely, the "thermoset layer", is not described by the term "layer" in the specification.

Referring to Figure 10 and to pages 24-26 of the specification, a cross-section of an alternate embodiment of the present invention is described. Applicant notes that reference numeral 128 refers to the thermoplastic region. Applicant wishes to draw the Examiner's attention to page 25 lines 18-19 of the specification where reference is made to the "protective layer or sheet region 128".

Applicant submits that at several points in the specification the thermoset and thermoplastic regions of the present invention are variously referred to by the terms "sheet", "region", "layer", "liner", "material", "mixture" and "portion". Examples may be found in the specification at: page 23, line 15; page 23, line 22; page 23, line 26; page 23, line 27; page 24, line 9; page 25, line 18; and page 26, line 22.

Applicant submits that "layer" is simply one of several terms that may be used to describe the components of the present invention, similar in meaning to terms such as "region", "stratum", "band", "section" and "portion". Applicant further submits that, in light of the specification, it is inherently evident that "layer", in part (a) of claim 47, identifies the mineral, porous substrate component of the invention. Use of "layer" in this sense is analogous to the use of "layer" to refer to the thermoplastic and thermoset layers. Applicant submits that "layer" merely serves to identify a component of the composite structural conduit, which is clearly described in

the specification and therefore does not constitute new matter.

Taking into account the specification as a whole, and in light of the preceding argument, Applicant submits that the use of the term "layer" to describe components (a) and (b) of claim 47 does not constitute new matter.

Applicant has provided clear antecedent support for the term "layer" by amending the specification at page 21 to incorporate a passage identifying the various components of the composite structural conduit as layers.

The Examiner states that claims 47-50, 52-57, and 59-60 are unpatentable over O'ffill in view of Rosemund and Muller and Ranney. More specifically, the Examiner states that:

> "[i]t would have been obvious to one having ordinary skill in the art at the time that the invention was made to add the silane adhesion promoters of Ranney to the isocyanate-based compositions of Rosemund and to employ those compositions as the carriers between the mineral-containing surface and the PVC liner of Offill in order to enhance the bonding of the PVC liner to the carrier and the carrier to the conduit surface. The motivation to employ Ranney's silane adhesion promoters in Rosemund's compositions for use in rehabilitating conduits with PVC liners, such as Offill's, is found in

Ranney's abstract, where Ranney says that silanes promote the bonding of polyurethanes to a variety of substrates."

The motivation to use Ranney's silane adhesion promoters in Rosemund's compositions to bond to PVC may, as the Examiner suggests, arise from the abstract of Ranney. The motivation to employ Rosemund's compositions to bond PVC substrates to brick and other substrates may, as the Examiner suggests, come from col. 8, lines 4 and 13-15 of Rosemund. However, contrary to the Examiner's suggestion in the above-quoted passage, there is no suggestion, in Ranney, Rosemund or Offill, that such compositions would find application in the bonding of thermoplastic liners for the purpose of rehabilitating pipes or conduits. In fact, to do so would directly contradict the explicit teaching of O'ffill.

In contradistinction to the Examiner's suggestion, the Applicant submits that O'ffill specifically teaches the use of an interlayer that bonds only to the pipe but not to the liner, as is evidenced by the following passages of O'ffill:

"The carrier is preferably formed from a cementitious material, such as cementitious grout and the like that is conventionally used to repair structure surfaces. Alternatively, the carrier can be formed from a resinous material that has good thixotropic properties and good

chemical and/or corrosion resistance when cured. The carrier cures to form a strong bond with the surface of the underlying substrate but not with the backside surface of the liner. The liner outwardly projecting members, and more specifically the head portion thereof, are completely surrounded by the carrier and are mechanically locked therein by curing action of the carrier.

The flexible liner of this invention is in the form of a noncontinuous diameter, i.e., is not in tubular form, that allows for the surfacing or rehabilitating of structures other than pipes that have a number of different geometries and sizes. The lack of bond formed between the carrier and liner back side surface permits the liner to remain flexible and insulated from the structure suface, thereby minimizing the possibility that cracks or tears in the flexible liner will develop due to subsequent cracks in the underlying pipe wall." (see O'ffill col. 4, lines 26-47)

"It is desired that the carrier cure to form a strong bond with the surface of the substrate but not with the back side surface of the flexible liner so that the only mechanism retaining the flexible liner against the carrier is the mechanical lock that is formed between the

OPM's and the carrier."(see O'ffill col. 7, lines 13-34)

It is desired that the carrier cure to form a strong bond with the surface of the substrate but not with [the] back side surface of the flexible liner so that the only mechanism retaining the flexible liner against the carrier is the mechanical lock that is formed between the OPMs and the carrier. The formation of a bond between the carrier and the flexible liner back side surface is not desired so that the flexible liner can remain flexible with respect to and independent from the adjacent wall surface. This eliminates the possibility of the flexible liner cracking or tearing as a result of cracks that develop in the substrate 24 and that are transmitted from the wall portion 32 to the carrier 36. Constructed in this manner, the flexible liner 30 is better able to protect against fluid or gas leakage from the pipe due to the development of such pipe cracks. Additionally, the flexible liner is better able to prevent ingress of ground water in to the pipe due to the development of such pipe cracks in applications where the pipe is buried at a depth equal to or below the ground water level. In such cases the ground water is passing through the cracks in the pipe is trapped between the pipe wall section and the back side surface of

the liner, and is thereby prevented from entering the pipe."(see O'ffill col. 7, lines 13-49)

Applicant submits that the above passages clearly indicate that use of Rosemund's compositions in order to bond to PVC is incompatible with Offill because it would result in adhesion of the flexible liner and carrier. This is further supported by the fact that Offill makes no mention of the techniques of Rosemund, although Rosemund was well known in the art at the time of the invention of Offill, having issued over 20 years prior.

Applicant reiterates that none of the references cited by the Examiner, alone or in combination, discloses means for strengthening a pipe or conduit. More specifically, there is no suggestion that the method of O'ffill contributes to the tensile, compressive, or flexural strength of the host structure. In fact, it is impossible for the liner of Offill to simultaneously remain flexible relative to the conduit and to contribute appreciably to the structural strength of the conduit. The Applicant further submits that it is well known in the art that the method of O'ffill cannot be used to repair pipes or culverts that have lost part of their steel reinforcement due to corrosion, and thus have lost their load bearing capacity. In such cases, new steel reinforcement must be added to the structure before lining with the method of O'ffill.

The applicant submits that, contrary to the teaching of O'ffill, the PVC liner of the present invention is fully

and continuously bonded to the thermosetting material (i.e., the carrier), which in turn is bonded to the substrate forming an integrated composite. In this way, the stresses experienced by the structure due to externally and internally applied loads (e.g., earth loads, live loads, hydrostatic pressure from ground water, etc.) are transmitted and transferred to the PVC via the thermosetting material. When stresses are transferred from the corroded host structure to the PVC liner, the host structure is effectively reinforced and the load bearing capacity of the original structure is improved. The amount of stress transferred from the host structure to the PVC liner depends mainly on the material properties of the PVC liner and thermosetting material, and on the thickness of each of these sections. The most relevant material properties are: (1) The modulus of rigidity and strength of the PVC liner, (2) the shear modulus of rigidity, and shear strength of the thermosetting material, and (3) the normal and shear bond strengths between the thermosetting material and the host structure, and between the thermosetting material and the PVC liner. The treated PVC liner of the present invention is chemically bonded to the thermosetting material by means of strong covalent bonds, rather than the mechanical locking and adhesion of O'ffill. The continuous covalent bonding of the present invention fixes the PVC liner to the thermosetting material so that the PVC liner is not flexible relative thereto (in contrast to the flexible liner of O'ffill). The continuous covalent bonding provides superior transfer of stresses from the

host structure to the PVC liner, resulting in a greatly reinforced and strengthened structure.

In particular, the flexural stiffness and strength of the host structure are significantly improved when the method described by the Applicant is applied on faces of the host structure that are under tension as a result of an applied bending moment. This circumstance occurs at the crown of all buried pipes and culverts. In turn, the crown is the part of a concrete pipe or culvert that is most susceptible to hydrogen sulfide induced corrosion, and it is the part that most frequently requires structural repair. Under the above-mentioned circumstances, the PVC sheet, via the thermosetting material, behaves as tensile steel reinforcement.

The Applicant has proven via testing that the application of the method of the present application can increase the strength of a corroded host pipe with severe structural damage (i.e., missing steel reinforcement) by 300 to 400 percent over the original design strength of the un-corroded pipe. It is important to note that the present invention is able to achieve this strengthening without significantly changing the hydraulic diameter of the host pipe.

Therefore, the Applicant submits that, although O'ffill discloses a means for surfacing or rehabilitating pipelines, it does not disclose a means for strengthening or reinforcing the host structure.

Further, the Applicant submits that Muller does not disclose means for strengthening a pipeline. In fact, Muller implicitly claims the opposite when it is stated that "the plastic resin of the outer layer does form an adhesive bond with the old pipe so that the old pipe and the lining tube form a unit whose statics are determined largely by the old pipe" (see Muller Col. 2, lines 41-48, see also Col. 3, lines 36-41). This statement indicates that the lining tube does very little to improve the load bearing capacity of the old pipe, in contrast to the method of the present invention.

In summary, the Applicant submits none of the references cited by the Examiner discloses the strengthening of a pipe or conduit. Furthermore, none of the references cited by the Examiner discloses fully and continuously bonding a thermoplastic liner to a thermoset material to rehabiliate a pipe or conduit. Bonding of the thermoplastic liner to the thermoset permits the transfer of stresses from the host structure to the thermoplastic liner, which is essential for strengthening and reinforcing the host structure.

In view of the foregoing amendments and remarks, favorable reconsideration of the Application is respectfully solicited.

Respectfully submitted,

Dated:_____ By: _____

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ANSWER 1 © 2002 ACS

CAS Registry Number

41618-91-1 REGISTRY

Chemical Name

2-Propenoic acid, 2-hydroxypropyl ester, polymer with chloroethene and ethenyl acetate (9CI) (CA INDEX NAME)
Acetic acid ethenyl ester, polymer with chloroethene and 2-hydroxypropyl 2-propenoate (9CI)
Ethene, chloro-, polymer with ethenyl acetate and 2-hydroxypropyl 2-propenoate (9CI)
.beta.-Hydroxypropyl acrylate-vinyl acetate-vinyl chloride polymer
.beta.-Hydroxypropyl acrylate-vinyl acetate-vinyl chloride copolymer
2-Hydroxypropylacrylate-vinyl acetate-vinyl chloride copolymer
Poly(vinyl chloride-co-vinyl acetate-co-2-hydroxypropyl acrylate)
Vinyl acetate-vinyl chloride-2-hydroxypropyl acrylate copolymer

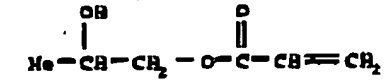
Molecular Formula

(C6 H10 O3 . C4 H6 O2 . C2 H3 Cl)x

Component

CM 1

Structure Diagram



Component

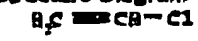
CM 2

Structure Diagram

Component

CM 3

Structure Diagram



CAS REGISTRY

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